WASHINGTON
HIGHER
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Bachelor of Science in Electrical Engineering
Eastern Washington University

INTRODUCTION

Eastern Washington University (EWU) seeks Higher Education Coordinating Board (HECB) approval to offer a bachelor's degree in electrical engineering through two similar, but different, methods of delivery. In fall 2004, the university proposes to offer the upper division component of a 2-plus-2 partnership program at North Seattle Community College, with the community college delivering the lower division courses. In fall 2006, the university would establish a complete four-year program at the main campus in Cheney.

The university's proposal marks the first time in Washington that a regional comprehensive university has sought state approval for a bachelor's degree program in electrical engineering. The university's eligibility was made possible by the enactment, in 2003, of legislation that permitted all Washington public universities to offer electrical engineering programs, subject to HECB approval. Previously, electrical engineering was among the "major lines of instruction" reserved in state law for the University of Washington and Washington State University. Both of the public research universities offer bachelor's programs in this field. Several private colleges and universities in Washington also offer electrical engineering degree programs.

Beginning with introduction of the legislation that set the stage for EWU's proposal, the question of whether the state needed a third publicly funded electrical engineering program has been seriously debated, with strong opinions on both sides.

In this context, the purpose of the Board's consideration at the March 25 meeting is to review the proposal with Board staff, receive public comment, and establish a timeline and process leading to final action on EWU's request at the regular Board meeting May 20, at WSU Vancouver.

This briefing document describes the proposal, summarizes the responses of interested parties, and lays a foundation for discussion at the March 25 meeting. Appendices include statements by reviewers commissioned by EWU, supplemental correspondence between the HECB and EWU; selected letters of support for or opposition to the project; and employment data from the state Employment Security Department.

OVERVIEW: HECB EVALUATION OF NEW DEGREE PROPOSALS

Decisions about the academic offerings of public colleges and universities are among the most important actions that the Higher Education Coordinating Board undertakes. Considerations relate directly to the opportunities available to students, the ability and responsibility of universities to provide high-quality instructional programs; the state's efforts to address statewide economic, educational and cultural priorities; and the requirement that citizens' tax dollars are invested wisely.

State law directs the HECB to represent the broad public interest above the interests of individual institutions. Therefore, the Board's highest obligations are to the students and taxpayers of Washington. The Board's review and approval process is designed to ensure programmatic quality, fairness to the proposing institution and all interested parties, and responsiveness to student and state interests. The Board strives to:

- Review all proposals for new degree programs fairly, thoroughly, and consistently;
- Ensure students who enter any new degree program can do so with confidence in the quality of instruction; and
- Fulfill the Legislature's charge to diligently oversee the investment of state funds for higher education, and to guard against unnecessary duplication of offerings among the colleges and universities in Washington State.

HECB PROGRAM APPROVAL GUIDELINES

The Board evaluates and approves new degree programs in accordance with the statutory direction in RCW 28B.340, as described in its January 2001 Guidelines for Program Planning, Approval and Review. To earn the Board's approval, an institutional proposal, informed by staff analysis, external review, and public comment, must document the following elements:

1. Clear evidence of state need for the program and consistency with the university's mission;
2. A development plan and proposed budget, including the amounts and sources of all funds;
3. Assurance that external and internal reviews attest to the quality of the program;
4. Avoidance of unnecessary duplication of existing programs;
5. A plan to assess overall program progress and effectiveness, including student achievement and learning outcomes;
6. A plan to expand opportunity for students from segments of the state population that have been historically under-represented in college participation; and
7. The appropriate use of technology to support instruction.

BACKGROUND

At the request of Eastern Washington University and the Washington Council of the AeA (formerly known as the American Electronics Association), the Governor and the 2003 Legislature enacted House Bill 1808, allowing all public Washington universities to offer electrical engineering programs, subject to the approval of the HECB. Previously, only the state's two public research universities were allowed to offer such degrees. Representatives of North Seattle Community College, the State Board for Community and Technical Colleges, and the University of Washington also endorsed the bill during legislative hearings.

As passed by the Legislature, HB 1808 included criteria to be employed by the HECB in reviewing electrical engineering program proposals. Some of these criteria duplicated existing HECB review elements, while others called for additional information and analysis. Governor Locke vetoed a section of the bill concerning review criteria, citing, in part, the existing statutory requirement for HECB program approval. However, in his veto message, the Governor supported the use of the evaluation criteria in the vetoed section of the bill. Shortly thereafter, two legislative leaders, Rep. Phyllis Kenney, chair of the House Higher Education Committee, and Rep. Don Cox, the committee's ranking minority member, wrote a letter to the Board, asking that the criteria from the vetoed section of HB 1808 be used to evaluate the degree proposal, and that the review should be based on information from multiple sources, not just that provided by the proposing institution. The following evaluation criteria were included in the bill:

- Detailed evidence of why the new program is justified, including size and scope of student, employer, and community demand for the program;
- The feasibility of using existing public and private capacity for the program and comparisons of the state cost of providing existing and proposed capacity;
- Projected future enrollment and substantiation of the enrollment estimates; and
- Additional information requested by the HECB regarding demand, need, and cost-effectiveness of the program.

The bill also directed the HECB to submit a complete analysis to the legislative higher education committees before taking final action on the proposal.

SUPPLEMENTAL GUIDELINES FOR ELECTRICAL ENGINEERING PROPOSALS

The HECB agreed to implement a program review process that reflected the evaluation criteria contained in HB 1808. As such, during fall 2003, HECB staff developed supplemental guidelines for electrical engineering degree proposals from comprehensive universities, in consultation with Eastern Washington University and the state's other public and independent institutions, the State Board for Community and Technical Colleges, the Legislature, the Governor's Office, and other interested parties.

The supplemental guidelines require the sponsoring institution to provide the following information:

1. Program accreditation requirements that are based on the national accreditation standards established by the Accrediting Board for Engineering and Technology (ABET);
2. Identification of jobs that typically require an undergraduate degree in electrical engineering;
3. Identification of the community colleges whose graduates will be recruited or are expected to enroll in the proposed program;
4. Documented employment demand for graduates of electrical engineering programs in the past five years, and projected demand during the next five years;
5. Documented demand in the state for the program in terms of economic development;
6. A comparison of electrical engineers' salaries in the state with those in other regions of the country as one indicator of relative work force supply and demand; and
7. Facilities and capital costs and non-recurring budget start-up costs by area of expense.

The supplemental guidelines require HECB staff to collect the following information:

1. The number of students who have enrolled in and graduated from existing undergraduate electrical engineering programs offered by Washington public and independent institutions;
2. The number of currently enrolled community college students who are taking the pre-requisite courses for a major in engineering;
3. The number of Associate of Science-Transfer, Track 2 (engineering and physics) graduates from each community college;
4. Average annual program costs and faculty-student ratio for each existing electrical engineering program offered by a Washington college or university; and
5. Identify the number of non-U.S. citizens working in occupations related to electrical engineering in Washington on H-1B visas and other federal employment visas.
6. For each undergraduate electrical engineering program offered by a Washington public or private institution, identification of:
    a. Capacity to serve additional students within current resources;
    b. Factors limiting enrollment capacity; and
    c. Non-recurring operating costs for start-up or expansion.
7. Information about institutions' plans to expand existing programs or restrictions that would prevent expansion; and state and local capital and operating costs associated with expansion.

EASTERN WASHINGTON UNIVERSITY PROPOSAL: BSEE

Overview

On December 1, 2003, Eastern Washington University submitted a proposal to offer a new Bachelor of Science in Electrical Engineering degree (BSEE), beginning fall 2004, as the upper division component of a 2-plus-2 program at North Seattle Community College, and in fall 2006, as a four-year program at the main campus in Cheney. The university said the program at North Seattle would initially enroll 25 full-time equivalent students and grow to 40 by 2008, while the Cheney program would initially enroll 20 FTE and grow to 30 FTE by 2008.

On March 3, HECB Executive Director James Sulton Jr. met with EWU President Steven Jordan and his staff at Cheney to learn more about the proposal. As a result of this discussion, EWU provided HECB staff with additional information to complement the initial proposal. **Appendix 1** includes this supplemental information.

(A copy of the original proposal is available upon request at the HECB office in Olympia.)

Relationship to Role and Mission

In its proposal, Eastern Washington University said it would achieve its mission by, among other things, "providing high-quality integrated, interdependent programs that build on the region's assets and offer a broad range of choices as appropriate to the needs of the university's students and the region." The university's mission statement indicates in part that the college, while based in the Spokane metropolitan area, will maintain learning centers elsewhere in the state.

Prospective Student Interest

EWU cites evidence of student interest in the program at North Seattle CC as follows:

- The University of Washington turns away about 200 qualified applicants every year, and EWU said many of these students may wish to attend another electrical engineering degree program at a nearby public university.

- The State Board for Community and Technical Colleges (SBCTC) reports that, each year about 100 students from community colleges transfer into electrical engineering programs at UW and WSU. In addition, the SBCTC reports that in 2001, Washington State University researchers conducted a telephone survey of 935 Bellevue Community College graduates. These students, who had not yet transferred, ranked electrical engineering sixth among their most popular major of interest. Some 15 students were identified in the survey as being enrolled in electrical engineering or pre-engineering programs. Another five students said they intended to transfer into EE degree programs, most at the University of Washington. Based on this survey, the SBCTC estimates about 100 students a year would seek entrance to a publicly funded electrical engineering program, but are either not admitted to the program of their choice or do not apply because of the highly competitive nature of the program.

- According to SBCTC, for every three students currently accepted for transfer into an electrical engineering program, another student is looking for a program spot that meets his or her need. Also, transfers from community colleges to four-year colleges are expected to grow by 5 percent per year through 2010. Given this trend, SBCTC forecasts 36 community college transfer students who would enroll in the NSCC program in 2004, and 17 who would enroll in the Cheney program in 2006.

As requested by HECB staff, SBCTC also reported that in 2002-2003, 475 students had completed the differential equations course that is taken almost exclusively for pre-engineering and pre-physics majors, and since the 2001-02 academic year, 529 students had earned an Associate in Science degree for transfer to an engineering, physics, or computer science program at a four-year college or university.

Employer Needs

More engineers work in the field of electrical engineering than in any other related occupation. Electrical engineers deal with the controlled application of electricity to solve problems. They may work with major power generating plants or tiny transistors, computers or radar, motors or lasers, power lines or stereos. According to the U.S. Department of Labor, electrical engineers design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use. Entry into the field requires a bachelor's degree in electrical engineering or electronic engineering.

Eastern cites numerous studies in support of its proposal, including reports by the Washington Council of the American Electronics Association (AeA), the Washington Technology Center, the Seattle-based Technology Alliance, the Spokane Regional Economic Development Council, and the Washington Technology Center. According to these organizations:

- Washington does not produce the number of bachelor's degrees necessary to attract and sustain technology-based industries;
- The number of bachelor's degrees granted in Washington in science and engineering is in the lowest third of the nation on a per capita basis;
- Technology and economic development thrives in states where education systems stress science and engineering, producing technologically sophisticated workers;
- Approximately 5,000 engineering positions in this state need to be filled each year, and Washington colleges and universities are only producing 2,000 to 2,400 engineering graduates annually; and
- Spokane-area colleges and universities should expand enrollments to meet workforce needs in academic fields that include information technology, engineering, and software development.

Eastern also presented forecast data prepared in June 2002 by the Washington State Employment Security Department, which predicted that between 2005 and 2010, the state would need about 200 additional electrical, electronics, and computer hardware engineers per year: 45 in Seattle-King County, and 8 in Eastern Washington/Spokane. (Eastern's proposed electrical engineering degree provides course work in electronics and computer hardware. Therefore, statistics on these engineers were reported.) A HECB staff review of the department's February 2003 forecast for 2005-2010 shows a projection for 127 additional electrical, electronics, and computer hardware engineers per year: 47 in Seattle-King County and 8 in Eastern Washington/Spokane.

EWU said about 25 companies in Washington State continue to seek graduates with backgrounds in electrical engineering. Also, the university reported that according to the 2002-2003 U.S. Bureau of Labor Statistics Occupational Outlook Handbook, the electrical engineering field is projected to be a fast-growing occupation between 2000 and 2010, with a projected growth rate of 10-20 percent. In Washington, electrical engineering is also projected to be a relatively high-demand field. One reason is the continuing growth of e-commerce and the development of technological devices to track business shipments, costs, and inventories in real time.

In addition, the HECB staff has reviewed the most recent data published by the Washington State Employment Security Department on unemployment insurance claims by electrical engineers, electronics engineers, and computer hardware engineers for February 2003 and February 2004. The department reports that total employment in all three fields in Washington increased between February 2003 and February 2004. Further, the total number of unemployment filings – and the jobless rate – declined in all three occupations during that time. The unemployment data is included in **Appendix 2.**

Description of proposed programs

Curriculum

The proposed BSEE curriculum consists of 12 sequenced quarters of full-time attendance, with a minimum of 180 credits required for graduation. Basic science courses, general education requirements, and introductory circuits and programming courses are offered in the first two years. The junior year includes classes in all branches of the engineering field and the senior year emphasizes electives and a capstone project. Three areas of specialization are available to students:

- Digital signal processing and/or communication systems;
- Microelectronics and/or very large-scale integration (VLSI) design; and
- Control systems.

Classes would be taught face-to-face and over the K-20 network for both the North Seattle 2-plus-2 program and the four-year program at the Cheney campus.

In addition, Eastern has indicated that students who wish to enroll at the main campus at Cheney, to complete the first two years of the North Seattle-based program, could do so beginning in fall 2004**.**

As outlined in Table 1 below, the proposal represents a standard curriculum for a bachelor's degree in electrical engineering, and it is based on program criteria specified by the Accreditation Board for Engineering Technology (ABET), which is the nationally recognized specialized accrediting agency for engineering education.

Table 1: EWU Bachelor of Science in Electrical Engineering - Proposed four-year curriculum

Lower Division

Fall		Winter		Spring	
Freshman					
Calculus I	5	Calculus II	5	Calculus III	5
Visual Literature & Performing Arts	5	Visual Literature & Performing Arts	5	Visual Literature & Performing Arts	5
English 101	5	English 102	5	English 103	5
Total	15	Total	15	Total	15
Sophomore					
Individual & Society	5	Individual & Society	5	Individual & Society	5
General Chemistry	5	Technical Writing	3	Linear Algebra	4
Engineering Physics I	5	Engineering Physics II	5	Engr. Physics III	5
Vector Calculus	3	Differential Equations	3	Digital Circuits	4
Total	18	Total	16	Total	18

Upper Division

Fall		Winter		Spring	
Junior					
Computer Programming	5	Signals and Systems I	5	Signals and Systems II	5
Fundamentals of Elec. Engineering	5	Electronics II	5	Microprocessors I	5
Electronics I	5	Circuits II	5	Approved Elective	5
		Digital Circuits II	2		
Total	15	Total	17	Total	15
Senior					
		Elec. Eng. Elective	5	Elec. Eng. Elective	5
Probability and Intro. to Statistics	5	Energy Systems	5	Technical and World Civilization	4
Elec. Eng. Elective	5	Cultural/Gender Diversity*	4	Capstone	4
Electromagnetism	4				
Total	14	Total	14	Total	13

*Lower division course

Goals and objectives

According to EWU, "The mission of the electrical engineering program at Eastern Washington University is to provide a comprehensive education utilizing the classroom, applied research, experience-based learning, and extensive laboratory experience. Additionally, students will be encouraged and challenged to investigate, innovate, incorporate and implement engineering knowledge in the solution of today's technological problems."

In keeping with ABET requirements, EWU developed detailed educational objectives to support this mission; designed a curriculum to achieve the educational objectives; and developed an ongoing curriculum evaluation process. The university also plans to establish an advisory board to ensure the program's effectiveness. Specifically, ABET requires accredited programs to have:

- Detailed published educational objectives that are consistent with the mission of the institution;
- A process to determine the objectives, and evaluation methods that are based on the needs of the program's various constituencies;
- A curriculum and processes that prepare students for the achievement of these objectives; and
- A system of evaluation that demonstrates achievement of the objectives and uses the results to improve the effectiveness of the program.

Student learning outcomes

ABET stipulates the student learning outcomes that engineering education must impart. Table 2 compares the ABET outcomes to those drafted by EWU.

Table 2: Comparison of Student Learning Outcomes

ABET Student Learning Outcomes	EWU Student Learning Outcomes
• Apply knowledge of mathematics, science and engineering	• Apply learned knowledge to practical problems and adapt to emerging applications of mathematics, science, engineering, and technology
• Function on multi-disciplinary teams	• Function effectively on a team
• Identify, formulate, and solve engineering problems	• Understand industrial engineering concepts • Understand electrical engineering terminology and processes
• Understanding of professional ethical responsibility	• Understand professional, ethical, and societal responsibilities
• Communicate effectively	• Write clearly and effectively to a variety of audiences • Communicate verbally, give presentations, demonstrate skills related to persuasion, listening and the consideration of other points of view appropriate for industry
• The broad education necessary to understand the impact of engineering solutions in a global and societal context	• Demonstrate respect for diversity and a knowledge of contemporary professional, societal, and global issues
• Recognition of the need for, and ability to engage in life-long learning	• Recognize a need for and ability to engage in life-long learning
• Knowledge of contemporary issues	• Demonstrate respect for diversity and a knowledge of contemporary professional, societal, and global issues • Faculty and students involved with advisory board
• Use techniques, skills, and modern engineering tools necessary for engineering practice	• Use typical engineering tools, hardware, and software in an efficient manner

Enrollment projections

EWU expects that the upper division component of the 2-plus-2 program offered at North Seattle CC would initially serve 25 FTE students and grow to 40 FTE students at full enrollment by 2008. The Cheney program would initially serve 20 FTE and grow to serve 30 FTE students at full enrollment, also in 2008. The university said students should be able to complete the upper-division portion of the program in six consecutive quarters.

The FTE enrollment targets and time-to-degree estimate are consistent with generally accepted enrollment levels and completions times for other undergraduate degree programs. However, the university's proposal does not address the issue of student attrition – that is, the number of students who enter the program but drop out before earning a degree – which has been cited by the AeA and others as a significant barrier to information technology degree production.

Personnel resources

ABET-accredited programs must demonstrate that the faculty has the skills and credentials to cover all areas of the program of study, and that there are enough faculty members to accommodate student-faculty interaction, advising and counseling, service activities, professional development, and interaction with practitioners and employers. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as professional engineers.

EWU reports that existing faculty resources to support the program include three assistant professors. One holds a Ph.D. in electrical engineering, and the other two have master's degrees. Upon HECB program approval, EWU would assign one faculty member full-time to North Seattle CC to coordinate and instruct in the program at that site, and conduct a search to hire an additional Ph.D. in electrical engineering who would be located at North Seattle. In 2005, a third Ph.D. in electrical engineering would be hired. EWU full-time faculty would teach the junior and senior level courses. Part-time faculty would be used as needed to teach elective courses. All faculty associated with the program would advise and counsel students.

The chair of the Department of Engineering Technology and Multi-media Design would dedicate 25 percent of his time to administering the program. A search has been initiated to hire a dean and director of the School of Computing and Engineering Science who would oversee the department. Half-time secretaries and lab technicians at North Seattle and Cheney would be hired to support the programs at both locations.

The proposal does not address library and student services personnel or other resources.

Facilities

The proposed program at North Seattle Community College would be housed in the college's High Technology Learning Center. This building was constructed in 1999 and provides 25,140 assignable square feet for instructional program use. The *Higher Education Facilities Preservation Study* conducted in 2003 by the Washington Joint Legislative Audit and Review Committee in consultation

with the Higher Education Coordinating Board, classified the facility in good condition with a minimal backlog of preservation need. The North Seattle CC campus digital/electronics laboratory in the High Technology Learning Center can accommodate about 100 students. It houses basic equipment (digital and circuit, power, networking, and personal computer labs) to support an electrical engineering program and, as of the 2003-04 academic year, is not utilized in the afternoon.

The proposed electrical engineering program at the Cheney campus would be housed in the new Computing and Engineering Sciences Building (Cheney Hall). This facility is under construction and is scheduled to open in 2005. It is designed to provide 56,000 assignable square feet of instructional program space in engineering technology and computing science. It will include digital and circuit, robotic and control, power, networking, and personal computer labs.

ABET specifies that classrooms, laboratories, and associated equipment must be adequate to accomplish the program objectives and provide an atmosphere conducive to learning. Appropriate facilities must be available to foster faculty-student interaction and to create a climate that encourages professional development and professional activities. Programs must provide opportunities for students to learn the use of modern engineering tools. Computing and information infrastructures must be in place to support the scholarly activities of students and faculty and the educational objectives of the program and institution.

Diversity

The university said it intends to establish a strong recruitment and retention infrastructure and initiate activities targeted to under-represented students. For example, a full-time recruitment/ advisor will be hired for high demand fields in EWU's School of Computing and Engineering Sciences. Targeted activities planned for both North Seattle and Cheney include:

- Developing in-depth and comprehensive admissions review criteria to evaluate prospective students, including interviews and attention to community service activities;
- Recruiting women and minority faculty and creating faculty development plans for promotion and tenure, whereby faculty would earn credit toward tenure for mentoring and retaining under-represented students in their departments; and
- Expanding working relationships with the regional GEAR-UP, Talent Search, and MESA (Math, Engineering, Science Achievement) programs.

Evaluations of program quality

Accreditation

In fall 1999, the Accreditation Board for Engineering Technology (ABET) accredited Eastern's computer engineering technology program for six years. In 2006, the university intends to seek ABET accreditation for its proposed electrical engineering program at North Seattle CC. The ABET *2004-2005 Policy and Procedure Manual* specifies new programs are eligible to apply for accreditation after graduating the first class of students. ABET's accreditation process entails review of a self-study report prepared by the institution, and an on-site evaluation by a team of scholars and practitioners in the field.

The ABET Engineering Commission decides whether an engineering program should be accredited based on the review of the university's self-study, recommendations by the visiting evaluation team, and the institution's responses to the evaluation team's report. Accreditation is usually granted for either two or six years, and it is retroactive for the preceding graduating class. Accreditation for a full term of six years indicates that a program satisfies all of the ABET criteria. If weaknesses exist or the future of the program appears questionable, the accreditation will be granted for a shorter period, usually two years. Factors that may limit the period of accreditation include uncertainty related to the program's financial status or administrative organization; a need for improvements related to staff, facilities, or equipment; a new or changing curriculum; or dependence on a single individual. In other words, if a department chair or other faculty member who plays a key role in establishing a program were to depart, would there be requisite institutional commitment and resources to sustain the program?

Student learning assessment

ABET stipulates the evidence that may be used to assess student learning. It includes, but is not limited to, student portfolios, design projects, nationally standardized tests, alumni surveys, employer surveys, and job placement of graduates. Student self-assessment, opinion surveys, and course grades are not, by themselves or collectively, acceptable methods for documenting achievement of outcomes. Results of the assessment are to be applied to the further development and improvement of the program.

EWU has designed an assessment process based on ABET accreditation guidelines. The university plans to assess student learning in each course through measurable objectives. The methods of assessment would include grades, evaluation of laboratory reports, employer and student surveys, and evaluation of engineering projects. These assessments would ensure the program is fulfilling its mission and continually improving; and would verify that graduates are prepared for their profession.

Ongoing program evaluation

ABET requires accredited programs to maintain a system of ongoing evaluation that demonstrates achievement of program objectives and uses the results of the evaluation to foster improvement. EWU has proposed program assessment procedures based on this requirement that would be coordinated by the chair of the Department of Engineering Technology and Multi-media Design. To implement this assessment:

- Students would complete course evaluations each term;
- Full-time faculty would be responsible for additions, deletions, changes, or modifications to the program in all areas of structure, process, and outcomes;
- A curriculum committee composed of EWU faculty, industry representatives, electrical engineering faculty from the UW or WSU, and engineering faculty from selected community colleges, would consider and implement curriculum changes; and
- Faculty, students, and administrators would have opportunities to provide input related to areas of structure, process, and outcomes.

Proposed budget

Table 3 presents a summary of estimated costs for the proposed program. EWU proposes the programs at North Seattle CC and the main campus in Cheney be supported in two ways: (1) through internal reallocation of existing funds; and (2) through a HECB high-demand enrollment grant, for which EWU intends to apply based on the Legislature's approval of enhanced high-demand funding for the 2004-05 academic year. Because there is no assurance that the university would receive a high-demand grant (allocations are made in response to competitive proposals), the university's proposed budget as outlined below is based exclusively on reallocated funds.

EWU has identified several available sources for reallocation within the university's budget, including additional enrollment funding provided in the 2004 supplemental state operating budget; tuition revenue realized from enrolling students above the state-supported level; and funds received in the 2003-05 biennial state operating budget to expand capacity to enroll upper-division transfer students.

The total estimated cost for the programs at North Seattle and Cheney is approximately $480,000 per year, which is equivalent to $6,860 per FTE student at full enrollment. Equipment replacement and maintenance costs are estimated to be $60,000 per year. Potential non-recurring start-up costs include $5,000 for program marketing; $8,000 for faculty recruitment; $2,000 for travel related to starting the program at North Seattle CC; and $26,000 for initial library expenses.

Table 3: Proposed budget for EWU Bachelor of Science in Electrical Engineering

			Program at North Seattle CC		Programs at North Seattle CC and Cheney campus		
Category	**Internal Reallocation**	**New State $**	**2004-2005[1]**	**2005-2006**	**2006-2007[2]**	**2007-2008[5]**	**2008-2009**
Administrative Salaries (.50 FTE Benefits @27%)[3]	$44,500	0	$44,500	$44,500	$44,500	$45,835	$45,835
Faculty Salaries (3 FTE Benefits @27%)[4]	$276,225	0	184,150	276,225	276,225	284,512	284,512
Clerical Salaries (.5 FTE Benefits @32%)[3]	$19,800	0	19,800	19,800	19,800	20,394	20,394
Technician Salaries (.5 FTE Benefits @32%)[3]	$23,760	0	23,760	23,760	23,760	24,473	24,473
Goods and Services	$35,000	0	35,000	35,000	35,000	35,000	35,000
Travel	$8,000	0	8,000	8,000	8,000	8,000	8,000
Equipment Replacement and Maintenance	$60,000	0	60,000	60,000	60,000	60,000	60,000
ABET Costs	$2,000	0			2,000	2,000	2,000
TOTAL	**$469,285**	**0**	**$375,210**	**$467,285**	**$469,285**	**$480,214**	**$480,214**
FTE Students			**25**	**40**	**60**	**70**	**70**
Cost per FTE Student[6]			**$15,008**	**$11,682**	**$7,821**	**$6,860**	**$6,860**

1. Program starts at NSCC
2. EWU on-campus program starts
3. 25% on EWU campus and 25% on NSCC campus
4. Faculty located on EWU campus and/or NSCC campus
5. Includes a 3% pay increase
6. Does not include $3509 incremental cost (indirect cost)

EXISTING ELECTRICAL ENGINEERING PROGRAMS

Five independent institutions in Washington (Gonzaga University, Henry Cogswell College, Seattle Pacific University, Seattle University, and Walla Walla College) and two public institutions (University of Washington and Washington State University) offer undergraduate electrical engineering programs. Table 4 displays enrollment and degree production for each of these programs over the last five years.

Table 5 summarizes the cost data submitted by institutions that currently offer bachelor's programs in electrical engineering. It also exhibits the projected costs of the EWU program. Due to existing capabilities and practices, not all institutions were able to report both direct instructional costs and total costs (direct and indirect costs).

These data indicate average per-student costs of the proposed EWU programs would be most comparable to the costs of programs offered by Gonzaga University and Walla Walla College. These institutions report the lowest costs of the institutions surveyed. There is a wide variation in reported costs, particularly the costs reported by the public four-year institutions. Many factors produce these differences, including institutional role and mission, type of faculty, faculty compensation levels, and faculty instructional credit load.

Table 5 also shows the student-faculty ratios reported by the institutions. The proposed EWU program would have the highest ratio, with 23 students per full-time faculty member. Of additional interest is the apparent lack of a uniform relationship between program costs and student-faculty ratios. Specifically, institutions with the lower ratios have both the lowest and the highest cost per student. Again, this may reflect the differences in type of faculty, faculty compensation, and faculty instructional credit load.

Table 4: Electrical engineering headcount enrollment and degrees granted 1999-2004

Institution	1999-00	2000-01	2001-02	2002-03	2003-04*
Gonzaga University	35/9	50/18	63/9	64/12	62
Henry Cogswell College	62/9	49/8	47/6	43/6	37
Seattle Pacific Univ.**	25/21	20/26	31/24	4/17	15
Seattle University	143/16	147/24	139/20	146/20	135
Univ. of Washington	450/137	505/165	523/222	472/196	461
Walla Walla College	66/8	56/11	46/11	39/6	37
Washington State Univ.	372/99	403/61	411/71	426/61	409
Total	**1,153/299**	**1,230/313**	**1,260/363**	**1,194/318**	**1,156**

*****2004 graduation information not yet available Source**: HECB survey, 2003**

**SPU reported the number of annual declared majors and number of graduates

Table 5: Summary of costs of electrical engineering programs
Average annual cost per FTE student

Institution	Direct Costs Only	Direct and Indirect Costs	Student to Faculty Ratio*
Eastern Washington Univ. (projected)	$6,860	$10,369	23:1
Gonzaga University	$5,985	Not reported	15:1
Henry Cogswell College	Not reported	$13,109	17:1
Seattle Pacific University	$9,363	Not reported	13:1
Seattle University	$8,671	Not reported	11:1
University of Washington**	$10,225	$15,736	18:1
Walla Walla College	$4,560	$9,700	18:1
Washington State University**	$10,593	$16,723	12:1

*Student to faculty ratios have been rounded to the nearest whole number. **Source**: HECB survey, 2003
**Direct costs are estimated based on the 2003 HECB Cost Study.

Enrollment growth capacity

Table 6 summarizes the reported enrollment growth capacity of the surveyed institutions and the resources needed to accommodate growth. The state's public research universities report they have no capacity for enrollment growth due to insufficient state funding. Consequently, they have imposed enrollment caps. However, both institutions report that their existing facilities could accommodate more students.

The independent institutions all report existing growth capacity (totaling an additional 462 students) and could respond to increased enrollment demand at their institutions. Other than the need for additional faculty, the colleges indicate few other growth requirements exist. (Note: Walla Walla. SPU, and Gonzaga growth capacity enrollment is headcount; Henry Cogswell, SPU, and SU is FTE.)

Table 6: Enrollment Growth Capacity

Institution	Capacity for additional enrollment	Growth requirements/constraints
University of Washington	0	Additional state enrollment funding needed for program growth.
Washington State University	0	Additional state enrollment funding needed for program growth.
Gonzaga University	62	Additional faculty would be needed. No other constraints reported.
Henry Cogswell College	180	No constraints reported.
Seattle Pacific University	60	Minor costs ($30,000) for additional equipment.
Seattle University	100	Growth would require additional faculty and minor capital outlay ($250,000).
Walla Walla College	60	An additional non-faculty staff position would be needed. No other constraints reported.

Source: HECB survey, 2003

EXTERNAL REVIEWS AND PUBLIC COMMENTS

Reviews of the program proposal commissioned by EWU

HECB program approval policy and procedures include soliciting external reviews conducted by experts in the discipline, as well as peer reviews conducted by Washington's baccalaureate institutions. Staff assess whether the reviews generally support the proposal or raise substantive issues and concerns that need to be addressed by the proposing institution.

Five external reviewers were commissioned by Eastern to review this proposal:

Larry L. Wear
Professor and Chair, Electrical and Computer Engineering Department
California State University, Chico, CA

Terri Fiez
Director and Professor, School of Electrical Engineering and Computer Science
Oregon State University, Corvallis, OR

Ping Hou
Staff Engineer
Fondus Communications, Inc. Sunnyvale, CA

Terry Decker
Product Marketing Manager
Alignment Technologies, Liberty Lake, WA

Tuanhai Hoang
President
Qualitel Corporation, Redmond, WA

Appendix 3 contains the written responses of the external reviewers. In summary, they identified the following strengths in the proposal:

- The program goals and objectives are consistent with what one would expect of a contemporary electrical engineering program and are compatible with the outcomes ABET requires each engineering program to demonstrate;
- The description of how the program meets all seven ABET criteria is well done and complete;
- The proposed program would provide local access for working professionals, and the courses would be offered at times that would accommodate working students; and
- Proposed labs and equipment include most of the commonly used equipment in industry, including logic analyzer, signal generator, spectrum analyzer, microprocessor test board, and software tools.

However, the external reviewers also expressed concerns that:

- The university over-estimates the need for the program and under-estimates its associated costs;
- Faculty and resources are insufficient to support high-quality programs and laboratories at both North Seattle CC and Cheney;
- The university lacks adequate resources to supervise, advise, and monitor students; and
- The student learning outcomes and assessment methodologies are too limited.

EWU responded to these concerns by showing that need for the program was well documented and program costs were reasonable; one full-time faculty member would be assigned to the North Seattle CC campus, and others would be hired to support the program; and that assessment would be based on a number of factors, including class grades and employer and employee surveys.

Comments by other public Washington colleges and universities

Representatives of the University of Washington, Washington State University, and Central Washington University also commented on EWU's proposal. In addition, the president of North Seattle Community College sent a letter endorsing the proposal.

- The UW indicated that the appropriate UW faculty and administrators had reviewed the proposal and did not believe it would conflict with the university's existing bachelor's degree program in electric engineering;
- WSU indicated that if EWU could gain program accreditation, if students could obtain professional licenses, and employers hire EWU graduates, the program would represent a contribution to the state's economy and work force development efforts; and
- CWU indicated that administrators did not believe the proposed EWU program would have an impact on any current or future CWU programs.
- North Seattle CC President Ron Lafayette said his college is fully prepared to deliver the requisite lower-division courses for the program. He said the proposed 2-plus-2 partnership is a cost-effective approach to addressing the need for highly skilled graduates in the Seattle area, and that the proposal corresponds with the HECB master plan, which calls for additional enrollment and program capacity in high-demand fields.

Comments from independent colleges and universities

Opposing views have been received from the Independent Colleges of Washington (ICW), which represents 10 of Washington's private four-year colleges and universities; and from representatives of Gonzaga University and Seattle University, both of which are members of the ICW.

- The ICW, said demand for electrical engineering education – and for EE graduates – has dropped significantly in the past four years. Currently, the state's six existing programs have the capacity to accommodate double the number of new enrollments contemplated in the EWU proposal. The ICW also expressed concern that EWU has understated the cost of achieving ABET certification, particularly the cost of recruiting and maintaining a "critical mass" of faculty to support programs at both North Seattle and Cheney.
- The dean of engineering at Gonzaga University said he and his counterparts across the country are concerned that recent corporate out-sourcing of electrical engineering jobs to other countries "is not simply a symptom of an economic downturn, nor a transitory phenomenon that will disappear with economic growth, but rather a fundamental structural shift in engineering employment by U.S. companies." He said many recent Gonzaga graduates in electrical engineering have been unable to find a job, while others have abandoned the discipline and a number of current students have changed their majors from electrical and computer engineering to the higher-demand fields of civil and mechanical engineering.
- The dean of science and engineering at Seattle University said each existing electrical engineering program in the state "will potentially be hurt by the addition of yet another program for which there is no current demand." He also said the North Seattle CC location lacked the infrastructure, faculty presence, and upper division math and physics courses to support the degree program. "In summary," he said, "this is a bad idea, at the wrong time, at the wrong place, and for the wrong reason. What could be worse?"

Appendix 4 includes letters from the higher education institutions and interested organizations.

Statements of support from interested parties

The HECB has fielded correspondence either expressing support for the proposed program or urging the Board toward an expeditious review of the proposal. Letters have been received from the Washington Council of the AeA; state Sen. Jim Horn, R-Mercer Island; state Reps. Don Cox, R-Colfax; Bill Fromhold, D-Vancouver; Fred Jarrett, R-Mercer Island; and Phyllis Kenney, D-Seattle. In addition, Brice Consulting, a technology consulting company in Redmond, submitted an endorsement.

Supporters cite a critical need for the program to meet industry demand and to serve students who would not otherwise have access to an affordable and conveniently located electrical engineering program.

The AeA said the total number of engineering graduates from Washington's public and private universities had fallen about 4.5 percent in approximately the last 10 years, compared to a decline nationwide of about 4 percent. The AeA said unless the state supports expansion of the pool of engineering graduates, "employers will be forced to hire from out of state, internationally, or choose to move their business where they can find people with the appropriate skills."

ANALYSIS AND PRELIMINARY FINDINGS BY HECB STAFF

The HECB staff offers preliminary findings and analysis based on the following:

- The staff's review of the EWU proposal, including communication with officials at the university since the original proposal submission in December 2003;
- Site visits by the HECB executive director to the Cheney campus of EWU and North Seattle Community College;
- Comments of external reviewers solicited by the university;
- Comments received from colleges and universities that have existing electrical engineering programs;
- Statements of support and opposition received from interested parties; and
- Communication with legislators about the proposal.

In that context, the staff's preliminary findings are as follows:

1. Eastern Washington University is responding to expressed needs and keenly felt desires to produce more baccalaureate degrees in electrical engineering in Washington. A major overture has come in the form of HB 1808, passed in 2003, which enables regional comprehensive universities to establish degree-granting programs in this field subject to HECB approval.

   The university and its community college partner have collaborated admirably in the preparation of this new degree program proposal. This includes regular communication and meetings among deans and faculty members at the respective institutions. All parties agree on the existence of underutilized facilities at North Seattle CC and that the necessary capabilities are in place to offer the programs. An equipment inventory has been conducted by EWU at the community college; the university has also examined prospective operations in the new engineering building on its own campus. The university has obtained equipment from external sources to make the program operational.

   Articulation and transfer have been systematized by EWU, not only with North Seattle CC, but also with Clark College, South Seattle Community College and Bellevue Community College. A university faculty member is prepared to undertake student recruitment for the program as early as this spring. EWU has full-time staff in place in Western Washington.

   EWU has no compunctions about its ability to graduate professionally competent people in this field of study. This confidence is based partially upon such achievements as the university placing highest in regional university competitions in computer science. The university is actively engaged in securing external funding to support students pursuing careers in science-related fields.

2. Any new degree program proposal has to address the same challenge as existing approved programs in Washington, i.e., the continuing decline of inflation-adjusted state funding for higher education. This proposal raises significant questions about the best manner of responding to reduced state funding, and it highlights the need for more carefully conceived state policy and academic planning for the future. The Board must determine sometime whether to promote innovative approaches to program delivery of the sort foreshadowed by this proposal or to advocate greater state support to expand existing programmatic capacity. It is crucially important to ascertain Washington's most cost effective method of program delivery.

3. Independent institutions of higher learning in Seattle and Spokane may already have the capacity to serve more students than those who would be served by the two proposed programs. Of course, reliance upon independent colleges and universities to fulfill higher education needs presents another significant policy issue to address.

4. Employer demands for electrical engineering baccalaureate degree holders in Washington remains subject to interpretation. From one perspective, employment in fields employing electrical engineers has increased during the past year. Concurrently, statewide projections of employers' future needs for electrical engineers (until 2010) have recently been revised downward by the Employment Security Department. Over the course of the last five years, existing bachelor's programs have annually produced approximately 300 electrical engineering graduates. In February 2002 the Employment Security Department projected statewide needs for about 200 more electrical, electronic and computer hardware engineers each year. The next year it reduced projections by nearly a third, to 127 new engineers per year in these fields. And, despite an improving general outlook on unemployment, more than 180 electrical engineers filed unemployment insurance claims with the state during February 2004.

5. The proposed budget and outline of the personnel and other resources needed for the programs at North Seattle CC beginning in fall 2004, and at Cheney in fall 2006, do not conclusively demonstrate that the university has the existing and potential resources that will be needed to initiate and sustain a high-quality electrical engineering program, as required by the HECB and ABET.

   Based on the university's proposed budget, it appears EWU does not anticipate its costs will increase in 2006, when it commences operation of the four-year BSEE program at the main campus in Cheney, in addition to maintaining the 2-plus-2 program at North Seattle CC. Total estimated funding is listed at $467,285 for 2005-06, the year before the Cheney program is proposed to begin. The following year, when the university hopes to offer programs in both locations, EWU estimates its total costs for both programs at $469,285. At full enrollment in both locations, the university estimates its total budget at $480,214. It is noteworthy that the reviewers commissioned by EWU expressed concern about the adequacy of the identified resources. The HECB staff believes it is unrealistic to assume no increase in costs during this period, even allowing for economies related to distance education, administrators who are responsible for overseeing both program locations, and other operational strategies.

6. It is generally accepted in higher education that making student enrollment and graduation projections is characteristically more art than science. Nonetheless, legitimate questions arise about whether a critical mass of qualified students exists to realize aspirations for success of the degree programs being proposed by EWU to be delivered in North Seattle and Cheney.

   More than 200 qualified applicants for admission into the electrical engineering undergraduate program at the University of Washington are rejected each year. Some of these students might elect to enroll in a 2-plus-2 program at North Seattle CC or a four-year program in Cheney. However, no definitive information has been provided about the subsequent academic career choices of unsuccessful program applicants.

The proposal cites information derived from a survey of transfer students from one community college. However, only a small number of the 935 students who were surveyed on behalf of Bellevue Community College subsequently enrolled or pursued interests in programs related to electrical engineering. One cannot conclude any demonstrable interest among community college students for the proposed program at this time. This happens because colleges are understandably reluctant to engage actively in normal recruitment activities prior to program approval.

Similarly, it remains unclear whether the un-utilized capacity in existing electrical engineering programs cited by independent institutions of higher education affords realistic options for the prospective pool of students that the proposed new programs intend to serve. For example, working adult students would not likely be able to afford attendance at independent institutions, or to synchronize classes with their schedules.

7. None of the resource concerns relative to this proposal is more important than faculty. This pertains to both current HECB and subsequent ABET consideration of the proposal. Neither entity will likely condone proposals with other than full-time core faculty members already in place to meet the instructional, advising and counseling needs of students. Moreover, they will also determine whether requisite faculty members are in place who make the scholarly achievements, research findings and public service commitments inherent in a high-quality program. EWU has identified current and future professional staff who would furnish constructive programmatic leadership and supply crucial student support services in North Seattle and Cheney. Questions remain about the provision of critical library/learning resources and student services.

Appendices

Appendix 1: Correspondence between the HECB and EWU

Appendix 2: Employment Security Department Data

Appendix 3: Written statements of the external reviewers commissioned by EWU

Appendix 4: Correspondence from higher education institutions and interested organizations